International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2011, Vol 13 No 4, Poster 563

Transfer Accuracy of Implant Impressions: Influencing Factors

Language: English

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Date/Event/Venue:
July 15-16, 2010
IADR - International Association of Dental Research
Centre de Convencions Internacional Barcelona, Barcelona, Spain

Introduction

An important step for the precise fit of implant retained restorations is an accurate three-dimensional transfer of the oral implant position onto the working cast. An inadequate superstructure may result in an implant loss.[1,2]
However, several studies reveal that true passive fit of multi-implant-supported denture to intraoral implant abutments seems unattainable.[3] As the quality of the implant impressions is affected by numerous factors: impression technique [4], impression material [5], impression tray [6] or the implant master cast technique [7], the ultimate ambition during the fabrication of an implant-supported denture is to obtain a precise impression.

Objectives

Hence, the aim of this study was to analyze the influence of the factors: impression technique (a) (pick-up versus reposition technique), implant system (b) and impression material (c) on the transfer accuracy of the implant position on the working cast.
The null-hypothesis was: None of the factors a), b) and c) does influence the dimensional accuracy of the working cast.

Material and Methods

An acrylic resin model of the maxilla with a steel base plate was used as a reference. Six implants of two different implant systems (3 Xive and 3 Ankylos; Dentsply Friadent) were fixed in the reference model (Fig. 1). The pick-up and the reposition impression techniques were used to make 10 impressions with the materials listed in Tab. 1. Master casts were fabricated with Fuji Rock (GC-Corporation, Tokio, Japan). Measuring abutments were fixed on the implant analogs and the 3D coordinates of each implant position was recorded with a 3D coordinate measuring machine (Rapid CNC, THOME, Germany; Fig. 1). Subsequently mean deviation (inclination, overall 3D shift in XYZ direction) was calculated in relation to the reference model. Statistical analysis was performed using ANOVA ($\alpha = 0.05$). For a better overview the data was presented in box and whisker diagrams.

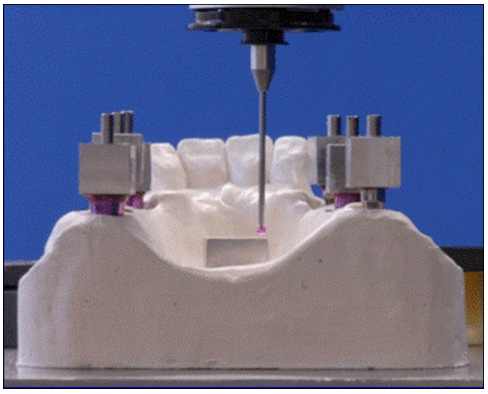

Fig. 1: Resin model with measuring machine

Impression material	Manufacturer	Type	Impression technique	Tray	Number of casts
Flexitime®	Heraeus Kulzer GmbH, Wehrheim, Germany	Polyvinyl-siloxane	Reposition	Custom	10
			Pick-up	Stock	10
P2 Polyether Magnum 360 Monophase®	3M ESPE, Seefeld, Germany	Polyether	Reposition	Custom	10
			Pick-up	Stock	10
Impregum Penta®	3M ESPE, Seefeld, Germany	Polyether	Reposition	Custom	10
			Pick-up	Stock	10

Aquasil Monophase®	Dentsply DeTrey, Konstanz, Germany	Polyvinyl-siloxane	Reposition	Custom	10
			Pick-up	Stock	10

Tab. 1: Impression materials and techniques

Results

(a) Impression technique
The impression technique had a significant influence on the inclination ($p<0.01$, Fig. 2a). The pick-up technique had a significant positive effect ($p<0.01$). Additionally the reposition technique showed a higher scattering of the values than the pick-up technique. There were no significant differences between the two techniques concerning the 3D shift ($p>0.05$, Fig. 2b).

(b) Implant system
The Ankylos system achieved a higher accuracy with regard to inclination (0.09 ± 0.02°) compared to the Xive implants (-0.15 ± 0.02°) ($p<0.01$, Fig. 3a).
However, the 3D shift was significantly smaller ($p<0.001$) with Xive implants (0.10 ± 0.06 mm) compared to Ankylos (0.14 ± 0.04 mm) ($p<0.001$, Fig. 3b). The Ankylos system had the highest accuracy for the 3D shift with the pick-up technique with a moderate variance.

(c) Impression material
The transfer accuracy was not significantly influenced by the impression material (ANOVA, $p>0.05$).
Two parts of the null-hypothesis (a,b) - except the impression material (c) - can be rejected.

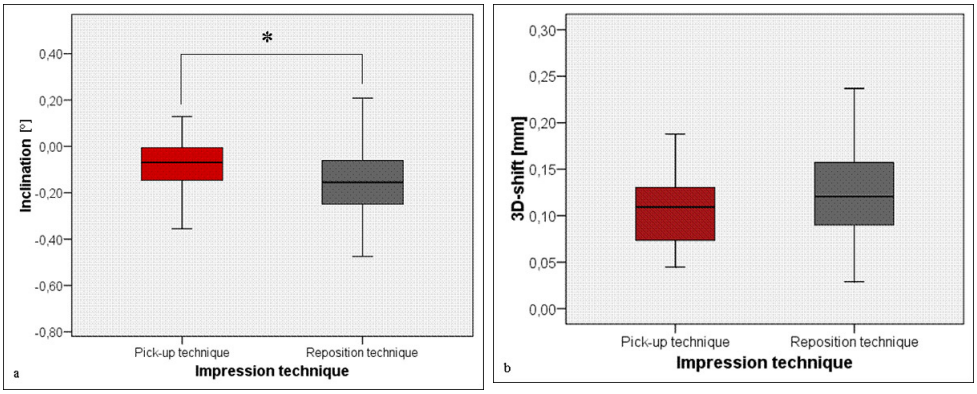

Fig. 2a-b: Impact of the impression technique on inclination (a) and 3D shift (b); * $p<0.01$, high significant

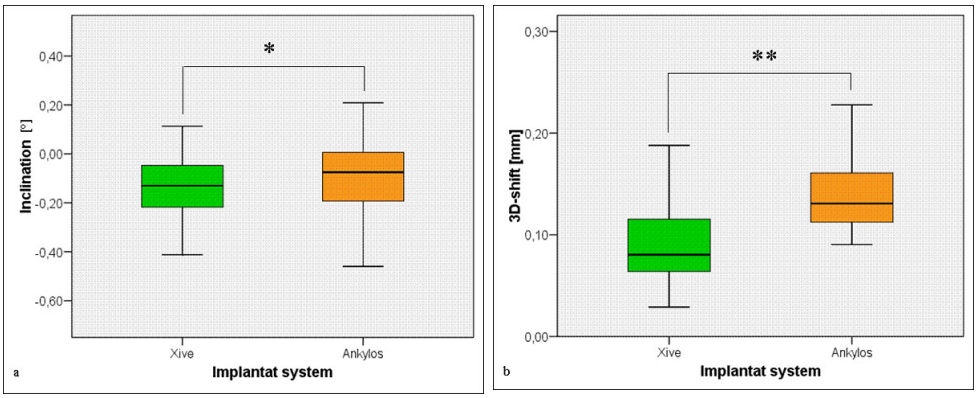

Fig. 3a-b: Impact of the implant system on inclination (a) and 3D error (b) * $p<0.01$, high significant; ** $p<0.001$, highly significant

Conclusions

The pick-up technique significantly improved the accuracy of the casts which was also reported by Wöstmann et al..[8]
The higher deviation in inclination with the reposition technique is most likely caused by replacing of the impression copings in the impression. This is in accordance with other studies which show that a larger spatial variation was recorded with the repositioning technique than the pick-up technique.[5] The different results of the transfer accuracy between the two implant systems might be caused by different impression posts or abutment designs. Ankylos implants have a stable and rotation-secured system and lead to a more precise reproduction of inclination. Whereas the hex base of the Xive implants provided better results in the 3D shift. The selection of the impression material has an inferior impact on transfer accuracy.
Under the limits of the study it can be concluded that the pick-up technique produces more accurate casts and should therefore be favoured for daily practice. Additionally every implant system shows a system specific influence.

Literature

- Conrad HJ., Pesun IJ., DeLong R., Hodges JS: Accuracy of two impression techniques with angulated implants. J Prosthet Dent 2007, 97, pp. 349-356.
- Jemt T., Rubenstein JE., Carlsson L., Lang BR: Measuring fit at the implant prosthodontic interface. J Prosthet Dent 1996, 75, pp. 314-325.

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Poster Faksimile:

Transfer Accuracy of Implant Impressions: Influencing Factors

#2875

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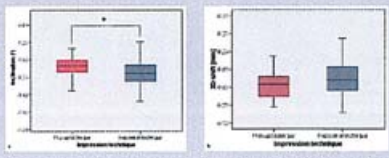

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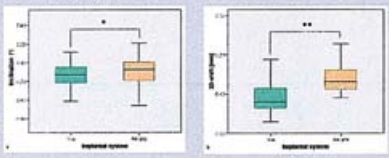

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